"The University College of Sheffield," and that women may participate in the benefits, emoluments, and government of the College to such an extent and in such a manner as the statutes of the College shall prescribe. There is to be no religious test for students, teachers, or other officers. The first president is the Duke of Norfolk, who is to hold office for five years, and be eligible for re-election. The first vice-presidents are Sir F. T. Mappin, Sir Henry Stephenson, Dr. H. C. Sorby, and Dr. Dyson.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 13.—"On a New Method of Determining the Vapour Pressures of Solutions." By E. B. H. Wade, B.A., Scholar and Coutts Trotter Student of Trinity College, Cambridge. Received April 26.

The statical methods, which have hitherto alone been capable of furnishing results between 60° C. and 100° C., have been attended with serious errors. The apparatus employed in this research was in conception similar to that of Sakurai, except that it was in duplicate, a divided steam supply passing through two U-tubes placed in parallel. It differed, however, from his apparatus in several important particulars, which cannot be adequately described in a brief notice.

Suffice it to say, that the pressure on the contents of the two U-tubes being the *same*, could be adjusted to any convenient value, and that the method of thermometry being the differential platinum one, the *difference* only of the boiling-points of pure water and salt solution, in their respective U-tubes, was recorded. Two series of observations were made at a pressure of 760 mm., in one of which a small external heat supply was used to compensate the condensation in the U-tubes, and a second in which it was found possible to dispense with it.

Neither method gives results differing systematically from the other, though the latter method was greatly preferred.

The substances examined were the chlorides of lithium, calcium, strontium, sodium, and potassium, and bromides of the two last named. A full discussion is here impossible, but we may notice that in all cases the ratio increase of boiling-point to concentration is of the same order as that calculated from Arrhenius' theory, but that the discrepancy always exceeds the experimental error, except in the case of potassium chloride, and is particularly great in the case of calcium chloride. The latter substance gave less well-defined boiling-points than the others which were investigated, for some reason as yet unknown, and the experimental error was here certainly at its greatest, but still not nearly enough to account for the difference.

May 14.—"An Attempt to cause Helium or Argon to pass through Red-hot Palladium, Platinum, or Iron." By William Ramsay, F.R.S., and Morris W. Travers. Received April 9.

A tube of hard, infusible glass was connected at one end with the reservoir of the gas under experiment, helium or argon. Into its other end was corked a tube of platinum, closed with a palladium cap, or, if iron was the metal under experiment, with a tube of thin wrought iron, also closed at the end; the closed end of the interior tube was placed so that it could be raised to a bright red heat by bringing a blow-pipe flame to bear on the hard glass tube. The open end of the metal tube was cemented to a glass tube, attached to a Töpler's pump, and provided with a Plücker's vacuum tube, so that the spectrum of any gas passing through the metal could be observed. This afforded, at the same time, a most delicate test of the presence of the gas under experiment. The metal tube was exhausted, until green phosphorescence appeared in the vacuum tube, and the gas, helium or argon, was admitted into the space between the glass and the metal tube, at atmospheric pressure. The glass tube was then heated to the highest temperature attainable with a blow-pipe—perhaps 900° or 950° C. In no case, whether the metal tube consisted of palladium, platinum, or iron, was there the smallest transpiration of gas, even after half an hour. The phosphorescent vacuum remained in all experiments quite unimpaired.

Physical Society, May 28.—Mr. Shelford Bidwell, President, in the chair.—Mr. Elder read a paper, communicated by Dr. Albert A. Gray, on the perception of the difference of phase by the two ears. The investigation relates to certain acoustical results obtained some years ago by Dr. S. P. Thompson; they may be summarised as follows: (*a*) When two simple tones in opposite phases are conveyed separately, through tubes or otherwise, to the two ears, the sensation of sound appears localised at the back of the head. (*b*) If the respective tones from two forks mistuned to give "beats" are conducted separately to the two ears, they still produce the sensation of "beats"; and, to the observer, this sensation also seems localised at the back of the head. The "beats" are distinct, but there are no true silences, at any rate so long as attention is fixed on the note. (*c*) Although "beats" are heard under these circumstances, no beat-tones are discernible by the binaural method. The author proceeds to explain the phenomena on the assumption that there is a physiological connection between the nerves of both ears. His evidence is derived from the following experiments: (*d*) A vibrating fork is held opposite one ear; the opposite ear is then closed by a finger; the sound of the fork now appears louder to the open ear. (*e*) If the fork is held opposite one ear, and the chain of ossicles of the second ear is then pressed gently inwards by a fine probe, the sound of the fork is heard with increased loudness by the first ear. (*f*) If the chain of ossicles in the second ear is dragged outwards by rarefaction of the air in the meatus, the above changes in loudness are no longer perceptible. The theory put forward by the author in explanation of these results is that they are due to reflex contractions of the tensor tympani or stapius (or more probably both) of the first ear. A further observation, of Pollak, is also brought to bear upon the question, *i.e.* (*g*) stimulation of one cochlea by sound causes contraction of the tensor tympani of both ears, and the contraction is permanent while the sound continues. This is known to be true for the lower animals, and is probably true for man. With regard to (*a*), the author observes that the muscular sense is there being appealed to in a manner quite new to it. The tympani are by nature trained each to relax or expand with the other, and they are thrown out of reckoning if the phases differ. Or, again, the stimuli from the two ears may collide at one of the lower nerve centres, and thus be annulled before any intimation has been received by the brain. The path taken by such stimuli is from the nucleus of one nerve, just after its entrance into the medulla, across to the corresponding nucleus of the opposite side. In these nuclei the stimuli from both ears mix. Some of the nerve-fibres have no nuclear intercommunication at the base of the brain; consequently, stimuli passing by these paths are not subject to interference. This agrees with (*b*), where the silences are not complete. (*h*) It is to be observed that beat-tones are sometimes perceived by the ear under circumstances where they cannot set a resonator into vibration. This indicates that beat-tones may be produced either in the ear or nerve-centres of the listener, and not exteriorly. (*i*) It has been shown by Dr. Thompson that when two simple tones, such as in ordinary hearing produce a differential tone, are led singly to the ears, no differential tone is heard. From this the author concludes that differential tones are not produced in the mind of the listener, nor in any of the cerebral centres. From (*h*) and (*i*) together, the point of production is restricted down to the ear itself; something of the sort was suggested by Helmholtz. Again, from (*g*), it appears that when two notes are sounded so as to give a differential tone, the tensor tympani must be in a state of continual contraction, for the intervals of silence are too short to permit of any relaxation. Meanwhile, there are certain periods during which the tympani membranes are not acted upon by any force external to the ear. The author is of opinion that if the movements of the ossicles upon one another were absolutely frictionless the membranes would come to rest in a position where the force of the contracting muscle was balanced simply by the tension of the membrane and the ligaments of the ossicles; but since the articulations of the ossicles have some friction, the equilibrium is otherwise, and he conjectures that the state of affairs is such that any force acting upon the hammer, tending to draw it inwards, produces a slight jerk, and this repeated gives the necessary impulses for the sensation of differential tones. The mechanics of this theory is not fully worked out.—Mr. J. Rose-Innes read a paper on the isothermals of isopentane. The author takes advantage of the recent experimental work of Ramsay and Young, upon the thermal properties of isopentane, to test a formula giving the relation of pressure to temperature for gases generally, over a considerable range of volume. From the linear equation, $p = bT - a$, for the pressure at constant volume, where a and b are functions of the volume, no formula could be found to give close agreement with observed results. More definite results are obtained by examining a quantity depending upon a and b together;

such a quantity is the temperature τ, at which, for each volume, the substance behaves as a perfect gas. It is shown by tables that τ is nearly a constant for volumes from 350 to about 8. Below volume 8 it diminishes very rapidly with volume. A further investigation refers to the $[(av^2)^{-1}; \ v^{-\frac{1}{3}}]$ curves of Young, for isopentane, and a corresponding formula. At volume 3·4 on this curve there is a decided peak, suggesting discontinuity. Ether gives a similar curve, and the question arises whether such curves would not be better represented by two or more equations. Prof. Young said the diagrams representing the observed and calculated isothermals were probably the best ever obtained. Divergence among the values of τ was explained in part by the smallness of the angle between the theoretical isochor for a perfect gas, and the real isochor. The point of coincidence was difficult to define. Moreover, the values of τ were obtained from "unsmoothed" values of v. The evidence against the linear law consisted in a certain similarity in the shape of the different curves. It was not easy to see where experimental errors could come in. The peak was a very striking feature of the curves, and the agreement between the results with ether and those of isopentane was very remarkable. These two substances had their boiling-points close together, their critical temperatures close together, and their molecular weights nearly alike. The two substances not only agreed in each giving a peaked curve, but the peak corresponded to almost identical volumes. Prof. Young hoped at some future time to examine normal pentane, and to determine whether τ was a constant for this substance also.—The President proposed a vote of thanks to the authors of the papers, and the meeting was adjourned until June 11.

CAMBRIDGE.

Philosophical Society, April 26.—Mr. F. Darwin, President, in the chair.—On the apparent electrification in an electric field at the bounding surface of two dielectrics, by Prof. A. Anderson.—On luminosity attending the compression of certain rarefied gases, by Mr. H. F. Newall. This paper contains a description of the circumstances under which phosphorescence has been observed by the author when certain rarefied gases (initially at a pressure of about 0·01 mm. to 0·05 mm.) are compressed into a volume about one-twentieth of the initial volume. The explanation of the phosphorescence in the case when oxygen is the gas used appears to be in agreement with the explanation given by Sutherland (*Phil. Mag.*, March 1897), of anomalies observed by Bohr and Crookes in the compression and rarefaction of this gas. According to Sutherland, in the rarefaction of oxygen a point is reached (pressure 0·7 mm.) when oxygen begins to be converted into ozone, and below the pressure 0·15 mm. the gas is entirely ozone. Between the pressures 15 mm. and 0·7 mm. the gas obeys Boyle's law as oxygen, and below 0·15 mm. it obeys Boyle's law as ozone. Between the pressures 0·7 mm. and 0·15 mm. the gas is a mixture of oxygen and ozone. Sutherland is led to the view that in the compression of ozone from the lowest pressures, the ozone begins, when the pressure reaches the value 0·15 mm., to be knocked to pieces in virtue of the frequency of collision between ozone molecules being the same as that of some natural vibration in the molecule. It appears that in the phosphorescence observed by the author as arising during compression of the rarefied gas from a pressure of about 0·02 mm. to pressures lying between 0·3 mm. and 0·5 mm., the ozone is converted into oxygen, and the energy evolved is regarded as resulting in phosphorescence. It is not clear, however, what part is played in the phenomena by the impurities, but it seems certain that their presence is of importance, if not essential for the production of the phosphorescence. The spectrum emitted by the phosphorescent gas is very striking, and consists of four bright bands, coinciding with those which Schuster has described as belonging to the spectrum of the negative glow of oxygen. When the same mixture of gas is at a higher pressure, it is possible to produce in it a bright phosphorescence by passing a momentary electrical discharge through it by Prof. J. J. Thomson's method. The phosphorescence is faint at a pressure of 0·6 mm., is at a maximum about 0·4 mm., and is not visible at a pressure below 0·1 mm. (These pressures vary with the impurities present in the mixture.) In the electrical production of phosphorescence in oxygen, it would appear (1) that the gas was initially mainly oxygen, (2) that the momentary discharge supplied it quickly with energy and converted it into ozone, and (3) that the ozone slowly reverted again to oxygen with phosphorescence. In this case, however, the spectrum exhibits no bright lines or bands, but is simply continuous. The author offers no explanation of the difference in the spectra in the two cases of phosphorescence, but calls attention to the probable importance of the observation in connection with astronomical matters and, in particular, with the luminosity of extended nebulæ.

PARIS.

Academy of Sciences, May 24.—M. A. Chatin in the chair.—Tools and weapons of the Copper Age in Egypt: methods and manufacture. New researches, by M. Berthelot. The objects described belong to most ancient Egyptian times, and consist of practically pure copper, no tin being present in any case. A careful examination of some copper needles, found in a tomb at Abydos by M. Amelineau, showed that they had been prepared from a thin lamina of metal, by folding over and subsequent forging. A small chisel obtained from the same place was found to have been made in a very similar manner. A hollow needle was formed from thin copper leaf, in a manner very similar to that employed at the present time in the manufacture of helical tubing for bicycles.—On some liquids contained in antique vases, by M. Berthelot. A liquid found in a flask near Rheims, probably dating from Roman times, showed that the flask originally contained a fat, into which, the flask being open, water filtered in.—Action on light upon gas mixtures, in case where it causes combination, especially on mixtures of hydrogen and chlorine, by MM. Armand Gautier and H. Hélier. No hydrochloric acid is produced from a mixture in equal volumes of hydrogen and chlorine if the latter are prepared and kept in the dark. This is the case even after prolonged exposure, one experiment extending over fifteen months. Similar results were obtained if the mixture was submitted to a very feeble illumination, such as a candle.—New study of tempests and tornadoes, by M. H. Faye. Remarks by the author on the presentation of his work to the Academy.—On the stay of General Poncelet at Saratow, by M. Germain Bapst.—New improvement of the grisometer, by M. N. Gréhant. The instrument is placed in a jacket with parallel glass sides, through which water is kept running.—The surface of cast-iron, kept at a red heat, is able to transform carbonic acid into carbon monoxide, by M. N. Gréhant.—On the elastic vibration and resistance of cannon, by MM. F. Gossot and R. Liouville.—Scientific mixtures, by M. Constant Dubois.—Remarks by M. Mascart on a catalogue of meteorological observations made in France since 1850, taken from the *Annales du Bureau central météorologique.*—On some doubts cast upon the laws of Colonel Goulier relating to the variations of length of levelling sights, by M. Ch. Lallemand. The observations cited, which are mostly produced graphically as curves, all go to confirm the accuracy of the conclusions drawn by Goulier.—On the reflection of light by a long and narrow surface, by M. Gouy. Some remarks on a paper by MM. Nichols and Rubens.—On a phosphorescent anti-anodic system, and the anode rays, by M. C. Maltézos.—On the properties of certain parts of the spectrum, by M. Gustave Le Bon. A reply to the criticisms of M. Becquerel concerning the transparency of ebonite for rays of low refrangibility.—On the precipitation of zinc sulphide in the estimation of this metal, by M. J. Meunier. The difficulties observed in the precipitation of zinc as sulphide are caused by the presence of a large excess of ammonium sulphide; they disappear if only just sufficient hydrogen sulphide is present to cause the complete precipitation of the zinc.—Remarks relating to the heat of formation of the sodium derivatives of acetylene, by M. de Forcrand. Taking into account the latent heat of fusion of acetylene, the latter being deduced from observations by Villard on the heat of formation of the hydrate $C_2H_2 + 6H_2O$, the amounts of heat developed by the successive replacements of the two hydrogen atoms in acetylene by sodium are very nearly equal, the formation of C_2HNa giving out a slightly greater amount (2 Cal.) than that of C_2Na_2.—Some new combinations of pyridine, quinoline, and piperidine with metallic salts, by M. Raoul Varet. — On the preparation of furfurane, by M. P. Freundler. The dry distillation of barium pyromucate gives a poor yield of furfurane, owing to the formation of gaseous products in a secondary reaction; but a quantitative yield is obtained on heating pyromucic acid in small quantities in sealed tubes at 260° to 275°, five grams of the acid giving in this way more furfurane than is obtained by the dry distillation of one hundred grams of the barium salt.—Solubility of ecgonine, by M. Œchsner de Coninck. The solubility of ecgonine is given for twenty-five organic solvents.—Comparative study of the changes in the respiratory quotients of fruits during ripening, by M. C. Gerber.—On the denaturation of alcohol, by M. Ernest Barillot. It is shown that the method of Dr. Lang employed in Switzerland for the denaturation of alcohol is of little use, since a simple treatment with a bisulphite, followed by a fractional distillation, is sufficient to recover 70 per cent. of the alcohol in a pure state.—On the embryonic shell of the Lamellibranchs, by M. Félix Bernard.—Disease of the branches of the mulberry in Turkey, by MM. Prillieux and Delacroix. The disease is caused by the attack of a parasite, *Sclerotinia libertiana*.—The subterranean hydrography of the Devoluy, by M. E. A. Martel.—Trophic troubles following the section of the posterior medullary roots, by M. J. P. Morat.—Influence of the stretching weight upon the heat disengaged by muscle during contraction, by Mlle. M. Pompilian.—On the antiquity of tatooing as a mode of treatment, by M. Fouquet.—Medico-legal appreciation of traumatic lesions and determination of individual identity by the X-rays, by M. Foveau de Courmelles.—On the three French balloon ascents and the third international experiment, by MM. Hermite and Besancon.—On the formation of acetic acid in a gas battery, by M. Gaudet.—On a means of stopping a leak from the outside of a ship, by M. Burgal.

DIARY OF SOCIETIES.

THURSDAY, June 3.

Royal Society, at 4.—Election of Fellows.——At 4.30.—The Sensitiveness of the Retina to Light and Colour: Captain Abney, F.R.S.—On the Mechanism by which the First Sound of the Heart is produced: Sir R. Quain, F.R.S.—Mathematical Contributions to the Theory of Evolution. On the Relative Variation and Correlation in Civilised and Uncivilised Races: Miss Alice Lee and Prof. K. Pearson, F.R.S.—An Investigation on the Variability of the Human Skeleton, with especial reference to the Naquada Race, discovered by Prof. Flinders Petrie in his Explorations in Egypt: E. Warren.—On the Brains of Two Sub-Fossil Malagasy Lemuroids: C. I. Forsyth Major.—(1) On the Dielectric Constants of certain Frozen Electrolytes, at and above the Temperature of Liquid Air; (2) On the Dielectric Constants of Pure Ice, Glycerine, Nitrobenzol, and Ethylene Dibromide, at and above the Temperature of Liquid Air: Prof. Fleming, F.R.S., and Prof. Dewar, F.R.S.—Preliminary Communication on the Nature of the Contagium of Rinderpest: A. Edington.

Linnean Society, at 8.—Observations on Termites: Dr. G. D. Haviland.—On the Genus Ramulina: Prof. T. Rupert Jones, F.R.S., and F. Chapman.

Chemical Society, at 8.—On the Thermo-chemistry of Carbohydrate Hydrolysis; On the Thermal Phenomena attending the Change in Rotatory Power of Freshly-prepared Solution of certain Carbohydrates, with some Remarks on the Cause of Multirotation: Horace J. Brown, F.R.S., and Spencer Pickering, F.R.S.—Optical Inversion of Camphor; Derivatives of Camphoric Acid. Part II. Optically Inactive Derivatives; Racemism and Pseudo-racemism: Dr. F. S. Kipping and W. J. Pope.—On some New Gold Salts of the Solanaceous Alkaloids: Dr. H. A. D. Jowett.

FRIDAY, June 4.

Royal Institution, at 9.—Signalling through Space without Wires: W. H. Preece, C.B., F.R.S.

Geologists' Association, at 8.—The Origin of the High-Level Gravel with Triassic Débris adjoining the Valley of the Upper Thames: H. J. Osborne White.

SATURDAY, June 5.

Geologists' Association—Excursion to Cheltenham and Stroud. Leave Paddington at 10.32 a.m.

TUESDAY, June 8.

Royal Institution, at 3.—The Heart and its Work: Dr. E. H. Starling.

Anthropological Institute, at 8.30.—Newly-discovered Stone Implements from Somaliland, and from the Lost Flint Mines of Egypt: H. W. Seton-Karr.—Anthropology in Brittany: Dr. Topinard.—Physical Anthropology of the Isle of Man: A. W. Moore and Dr. John Beddoe, F.R.S.——*Probable* Papers: The Walloongurra Ceremony: R. H. Mathews.—Prehistoric Diamond Fields: W. H. Penning.—The Capping Ceremony in Korea: Dr. E. B. Landis.

Royal Photographic Society, at 8.—Photographic Surveys: C. J. Fowler.

WEDNESDAY, June 9.

Geological Society, at 8.

THURSDAY, June 10.

Mathematical Society, at 8.—Models of the Regular Convex and Star Solids: W. W. Taylor.—The Calculus of Equivalent Statements (Sixth Paper): H. MacColl.

FRIDAY, June 11.

Royal Institution, at 9.—Diamonds: W. Crookes, F.R.S.

Royal Astronomical Society, at 8.

Physical Society, at 5.—The Effect of Sea-water on Induction Telegraphy: C. S. Whitehead.—A New Definition of Focal Length, and an Instrument for its Determination: Thomas H. Blakesley.—On the Decomposition of Silver Salts under Pressure: Dr. J. E. Myers and Dr. F. Braun.—On a New Way of determining Hysteresis in Straight Strips: Dr. Fleming, F.R.S.

Malacological Society, at 8.

SATURDAY, June 12.

Royal Botanic Society, at 4.

London Geological Field Class.—Excursion—Coulsdon to Merstham. Lower Chalk. Leave Cannon Street, 2,17; arrive Coulsdon, 2.59.

BOOKS, PAMPHLETS, and SERIALS RECEIVED

Books.—The Induction Coil in Practical Work: Lewis Wright (Macmillan).—Report on the Working and Results of the Woburn Experimental Fruit Farm since its Establishment: the Duke of Bedford and S. U. Pickering (Eyre).—An Essay on the Foundations of Geometry: B. A. W. Russell (Cambridge University Press).—Hypnotism and its Application to Practical Medicine: Dr. O. G. Wetterstrand, translated by Dr. H. G. Petersen (Putnam).—Abel's Theorem and the Allied Theory, including the Theory of the Theta Functions: H. F. Baker (Cambridge University Press).—A Manual of Botany: Prof. J. R. Green, Vol. 1, new edition (Churchill).—Illustrative Cloud Forms: Captain C. D. Sigsbee (Washington).—Among British Birds in their Nesting Haunts: O. A. J. Lee, Part 4 (Edinburgh, Douglas).—Lessons in Elementary Practical Physics. Vol. 3, Part 1. Practical Acoustics: C. L. Barnes (Macmillan).—Einführung in der Theorie der Analytischen Functionen einer Complexen Veränderlichen: Prof. H Burkhardt (Leipzig, Veit).—Africa, Antropologia della Stirpe Camitica: G. Sergi (Torino, F. Bocca).—Twelve Charts of the Tidal Streams near the Channel Islands and neighbouring French Coast: F. H. Collins (Potter).—Cours Supérieur de Manipulations de Physique: Prof A. Witz, deux édition (Paris, Gauthier-Villars).—Guide to the Genera and Classification of the North American Orthoptera found North of Mexico: S. H. Scudder (Cambridge, Mass., Wheeler).—Telepathy and the Sublimal Self: Dr. R. O. Mason (K. Paul).—Electric Movement in Air and Water, with Theoretical Inferences: Lord Armstrong (Smith, Elder).—The Outlines of Physics: Prof. E. L. Nichols (Macmillan).—Formation de la Nation Française: Prof. G. de Mortillet (Paris, Alcan).

Pamphlets.—Längenänderung und Magnetisirung von Eisen und Stahl: G. Klingenberg (Berlin, Simion).—Ueber den Gebrauch der von Prof. E. v. Federow, herausgegeben Stereographischen Netze (Leipzig, Engelmann).—Homogene Structuren: Barlow (Leipzig, Engelmann).

Serials.—Botanische Jahrbücher, &c., Vierundzwanzigster Band, 1 Heft (Leipzig, Engelmann).—Proceedings of the Royal Society, Edinburgh, Session 1896–97, Vol. xxi. No. 4, pp. 249–312 (Edinburgh).—Humanitarian, June (Hutchinson).—Natural Science, June (Page).—Chambers's Journal, June (Chambers).—Contemporary Review, June (Isbister).—National Review, June (Arnold).—Century Magazine, June (Macmillan).—Astrophysical Journal, May (Chicago).—Notes from the Leyden Museum, Vol. xviii. Nos. 2, 3, 4 (Leiden).—Scribner's Magazine, June (S. Low).

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